Four New Diclidophorids (Monogenoidea) Parasitic on the Gills of Marine Fishes from the Southwest Coast of India

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DURING THE COURSE OF STUDIES on the parasites of marine food fishes from the Indian seas, in the Marine Biological Laboratory at Trivandrum and the Central Marine Fisheries Research Institute at Mandapam Camp, the author collected four new species of monogenetic trematodes belonging to the family Diclidophoridae Fuhrmann, 1928. These species are described below. The collection and treatment of specimens was as described in a previous work (Unnithan, 1957:28–29).

Family DICLIDOPHORIDAE Fuhrmann, 1928, *sensu* Price, 1943
Subfamily DICLIDOPHORINAE Cerf., 1896, *sensu emend* Price, 1943
Upenicola n. gen.

GENERIC DIAGNOSIS: Diclidophorinae with a mazocraeid body shape; haptor constricted posteriorly, without extension of internal organs except the unbranched terminal ends of the crura; clamps, like sucker frames, with heavy cuticularization; clamp skeleton, though it resembles *Diclidophora,* is much different; no muscular incipient sucker present in the clamp; lappet absent; prepharynx present; male genital pore armed with six hooks; cirrus and penis absent; testes intercrural, postovarian; vitellaria large; ovary median, bent, club shaped, vaginal duct present; vitelline ducts absent; huge pasprostatica present. Parasitic on the gills of marine fishes.

GENOTYPE: ***Upenicola upeneoides*** n. sp.

Upenicola upeneoides n. sp.
Figs. 1–5

Body elongate oval, anterior fourth tapering with rounded tip, posterior fourth formed by the haptor, haptor demarcated from the rest of the body by a shallow constriction on each side, haptor with a prominent posterior median notch and three shallow lateral notches on each side (Fig. 1). Total length 2.9 mm; maximum width across middle of the body, 63 μ.

Mouth subterminal and crescentic; oral pouches spherical with a thick muscular rim, right pouch 63 μ and left pouch 58 μ in diameter; prepharynx small, spherical, 21 μ wide, situated between the oral pouches; pharynx fairly large, spherical (Fig. 2), anterior border slightly overlapping the prepharynx. From the oral pouches and the pharynx short thin parallel muscle fibers run backward to the level of the male pore. Oesophagus wide but ill-defined and unbranched, bifurcates into the intestinal crura about 535 μ from the anterior end of the body. The crura are wide and extend into the haptor where they end blindly close to one another; distal ends of the crura slightly enlarged, the outer branches of each crus simple short and wide, intercrural branches short and ill-defined except in the testes zone; crura in the haptoral region devoid of lateral branches; crura and their branches obscured by the large overlying vitelline follicle.

Haptor mazocraeid in shape, almost as wide as body with four clamps on each side of the posterior median notch, each clamp situated in the apex between the two adjoining notches, spherical or ovoid, 63 × 63 μ–63 × 84 μ, right and left clamp symmetrical, sessile; clamp capsule devoid of oblique striae, lip of the capsule narrow and thin; clamp sclerites (Fig. 3) more or less declidophorid in structure but shape slightly different, cuticularization is greater and the fleshy structure noticeable in diclidophorid clamps absent, distal end of the median spring highly expanded; terminal median lappet absent.

Testes 11, arranged in two unequal longitudinal rows, 7 in the right and 4 in the left row, postovarian and intercrural, rectangular or oval 63 × 21 μ–63 × 84 μ; vas deferens thin and narrow, originates from the anterior region

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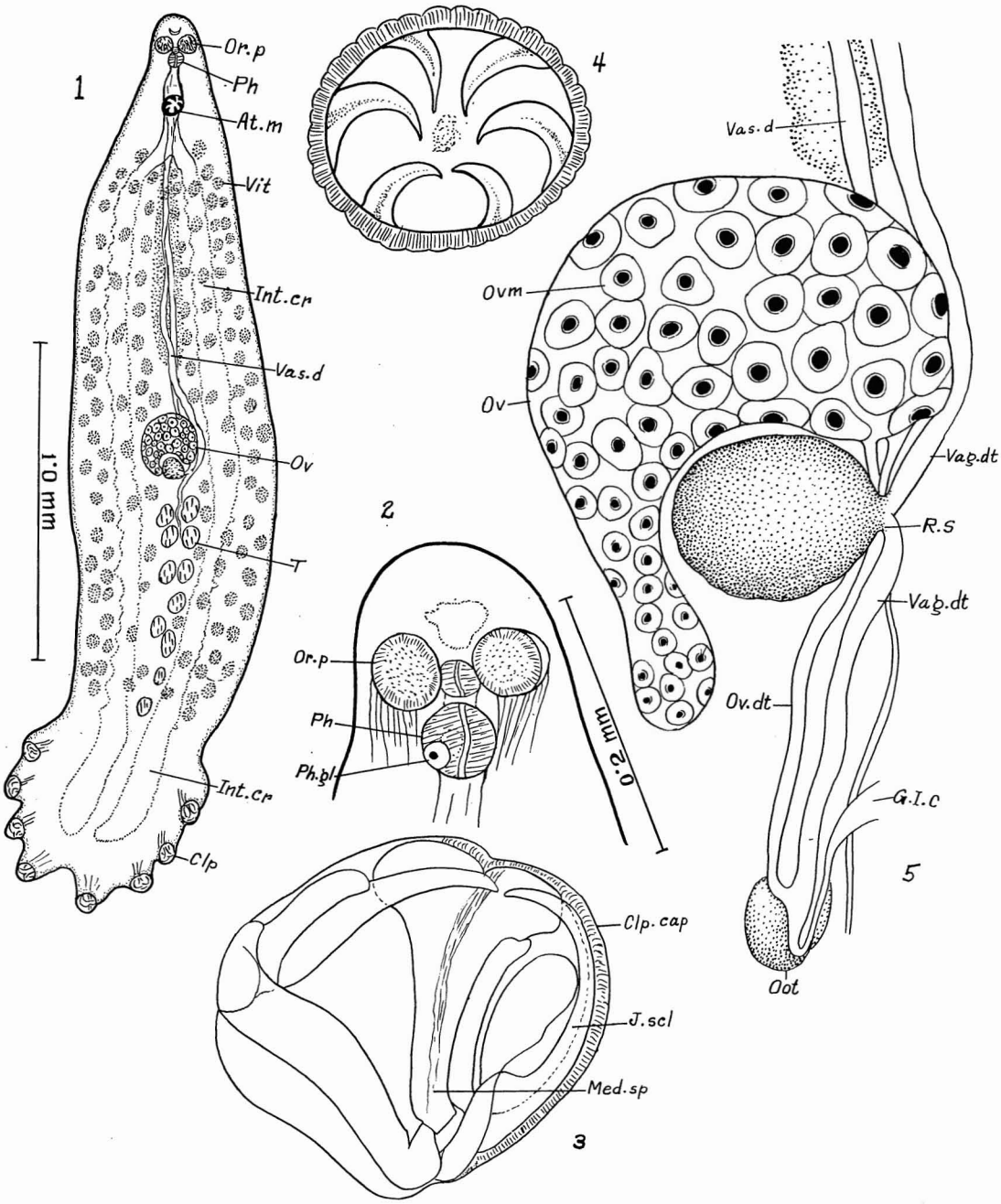


FIGS. 1–5. *Upenicola upeneoides* n. gen., n. sp. *1,* Complete worm, dorsal view; *2,* anterior region, dorsal view; *3,* second anterior clamp of the right side, dorsal view; *4,* male genital pore showing the armature, ventral view; *5,* ovarian region, dorsal view.

of the testes and passing beneath the ovary opens into the male genital pore. In front of the ovary it is surrounded by a large pasprostatica 631 μ long and 168 μ wide, which extends to the angle of the intestinal bifurcation. Male genital pore situated 294 μ from the anterior end of the body, is ventral circular, with a thin rim and armed with six conical, curved spines (Fig. 4). Penis and cirrus not observed.

Ovary simple, somewhat club-shaped, with a large distal portion, 210 × 189 μ (Fig. 5) and situated in front of the testes zone, curving round the median seminal receptacle; ova of different sizes, largest ones being present at the distal end; oviduct thin and narrow, originates from the posterior corner of the distal part of the ovary, runs backward parallel to the male genital duct, and opens into a spherical dilatation, probably the ootype. Uterus not very clear. Egg not observed.

Vitellaria present along the lateral field from the level of the intestinal bifurcation to the junction between the ovary and the haptor, not confluent posteriorly; follicles not very numerous but large, spherical or polygonal, 63–82 μ wide. Transverse and median vitelline ducts not very distinct.

Vagina absent (?), but a vaginal duct is traced arising from the spherical deeply stained region (ootype) close to the terminal end of the oviduct and emptying into the huge receptaculum seminis. This duct is filled with a dark substance, probably a mixture of foreign sperms and vitelline matter. Receptaculum seminis irregularly oval 105 × 84 μ, accommodated almost within the curve of the ovary. From the receptaculum seminis the vaginal duct can be traced as a more median, narrow duct up to the anterior level of the ovarian zone beyond which it is indistinct; this duct also is filled with dark matter as in the previous duct.

HOST: *Upeneus vittatus* (Forskål), on the gills.

LOCALITY: Trivandrum (southwest coast of India). One specimen collected 19 April 1956.

DISCUSSION

The genus *Upenicola* closely resembles *Diclidophora* Diesing, 1850, in the shape of the body, structure of the clamps, absence of vagina, structure of the male genital pore, etc. But in *Upenicola* the haptor is clearly demarcated from the body and the clamps are sessile, with greater cuticularization of sclerites, and the fleshy structures of Diclidophorids are absent. Though a vaginal pore is apparently absent it is presumed that a temporary slitlike opening may be present for the outlet of the contents in the vaginal duct, which is so well formed. This aperture may be formed at the terminus of the vaginal duct at the time of sperm transference. The distribution of the testes is unique in this monogenoidean. In *Diclidophora* there are numerous testes, which occupy both intercrural and extracrural regions, and some posterior ones may also extend into the haptor. But in this species the number is limited to 11, more or less, and they are confined to the intercrural region between the ovary and the haptor. Moreover, there is no penis or cirrus in this species, while a pasprostatica is well developed; but in *Diclidophora* a penis or cirrus, as the male intromittent organ, is always present and a pasprostatica is absent. Another important difference is that, while in *Diclidophora* the male intromittent organ is armed with numerous spines, in the present species the male pore carries only six curved spines. Also the vitelline follicles are larger and fewer, and a prepharynx is present.

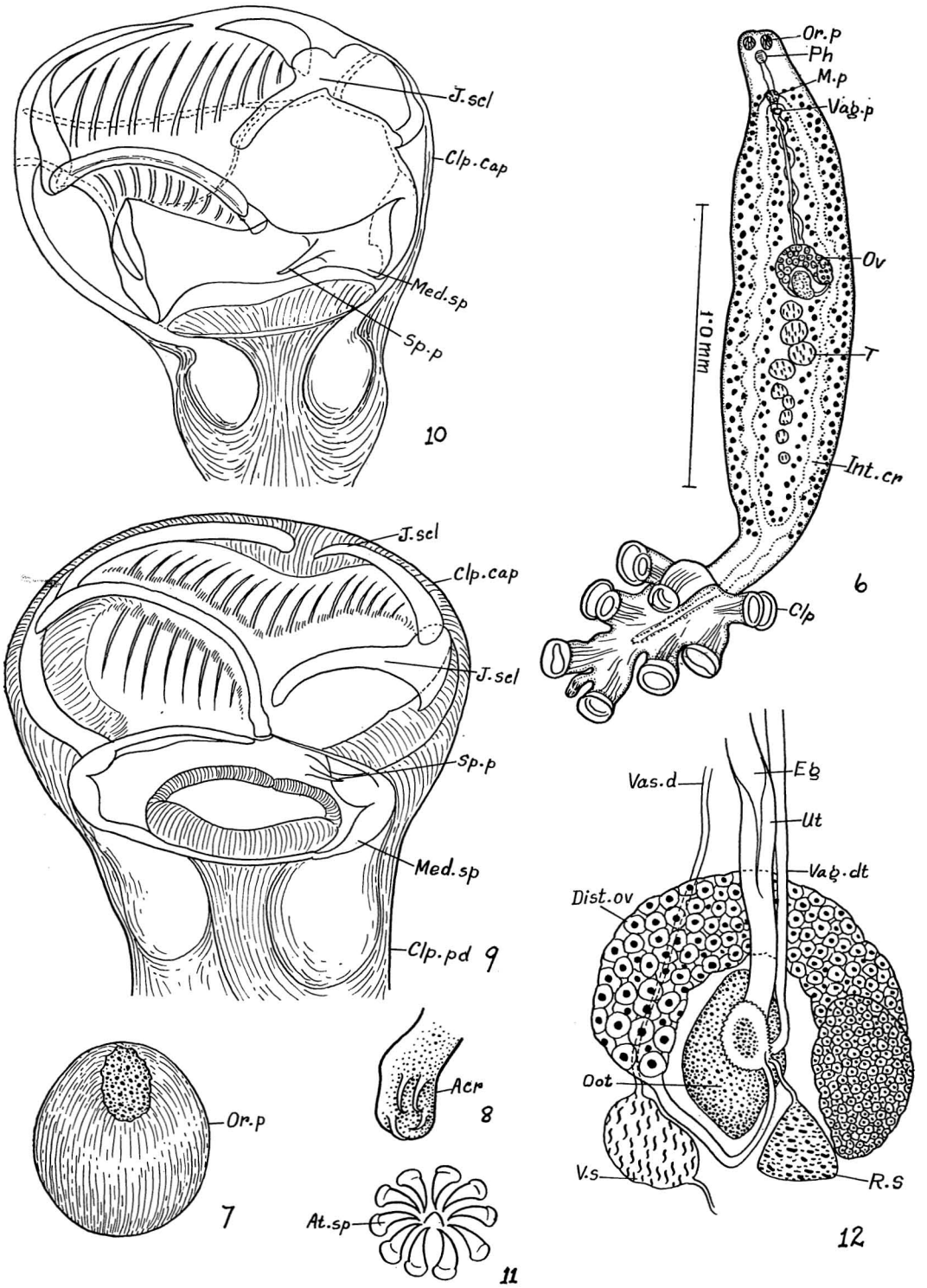
These marked differences make it necessary to create the new genus *Upenicola* to accommodate the new species.

The generic name signifies that the gill trematode inhabits *Upeneus* spp. of fishes, and the specific name is the name of the host.

Subfamily CHORICOTYLINAE Sproston, 1946

Urocotyle n. gen.

GENERIC DIAGNOSIS: Choricotylinae, with a short stem separating the haptor from the body proper; clamps pedunculate, choricotylid, with more advancement; median spring in the form of a ring at the base of the clamp and with the ventral half broader, platelike, with long cuticularized peglike spine arising from it; riblike cuticularized thickenings present; abaxial and adaxial half asymmetrical; with tail-like anchored lappet; male genital pore armed; vagina present, unarmed, behind the male genital pore;



FIGS. 6–12. *Urocotyle pristipoma* n. gen., n. sp. *6,* Complete worm, ventral view; *7,* oral pouch; *8,* terminal lappet with anchors; *9,* distalmost clamp of the left side, dorsal view; *10,* distal second clamp of the left side, ventral view; *11,* armature of the male genital pore, ventral view; *12,* ovarian region, dorsal view.

oral pouches "saccular"; ovary C-shaped, testes postovarian; vitellaria large; receptaculum seminis and seminal vesicle present. Parasitic on the gills of marine fishes.

GENOTYPE: *Urocotyle pristipoma* n. sp.

Urocotyle pristipoma n. sp.
Figs. 6–12

Body spindle-shaped, connected by a short narrow isthmus with a haptor (Fig. 6). Total length 2.83 mm and maximum width 0.429 mm across the middle of the body proper.

Mouth subterminal, slitlike, transversely elongate and situated immediately in front of the anterior border of the oral pouches. Oral pouches (Fig. 7) almost spherical or vesicular, 52 × 42 μ, with a narrow oval aperture which is plugged with a dark substance; wall of the pouch thick, muscular, and fibrous. (It is interesting to note that the oral pouches of this species are slightly more advanced than are those of Microcotylidae and Gastrocotylidae, showing a remote resemblance to a sucker-like structure embedded in the body muscle, and are devoid of the long and wavy muscle bundles which are usually found attached to the oral pouches of many species of Microcotylidae and Gastrocotylidae.) Pharynx median, oval, thin-walled, more or less the same size as the oral pouches, 52 × 40 μ. Oesophagus short, narrow, and without branches, bifurcating into the two crura at the level of the male genital pore, 0.185 mm from the anterior end; crura fairly wide, with irregular lateral pouchlike bulgings. In front of the narrow isthmus between the body and haptor the two crura become confluent across the median line, and the resulting single median unbranched crus extends through the isthmus as a tapering tube into the haptor about two-thirds its total length (Fig. 6).

Haptor one-fourth the total length, with four pairs of symmetrical clamps and a median posterior tail-like lappet. Lappet cylindrical, 147 × 42 μ, and armed with double pair of anchors, of which the anterior pair is prominently hooked and measures 12 μ in length, while the posterior pair is shorter (8 μ long) and only slightly curved. Clamps with stout cylindrical muscular peduncles; clamp capsule thick and fleshy with broad fleshy lips. Each clamp with a broad, well-developed, cuticularized sclerite at the base, the lateral ends of which arch upwards as a flap on each side, the adjacent posterior margins being connected dorsally by a thin, narrow, cuticularized bridge, the entire structure thus forming an uneven ring. This structure represents the median spring. From the inner surface of this broad ventral platelike sclerite a long and narrow peglike, heavily cuticularized spine projects into the clamp capsule. The rest of the clamp armature resembles more or less that of *Choricotyle* except that here it appears to be more advanced in structure. It consists of a pair of oblique sclerites, one long and narrow, the other short and broad; the inner end of the shorter is articulated with the inner end of the longer, which in turn is attached to a small concavity on the anterior margin of the median ring sclerite. There is a second pair of unequal sclerites with slightly curved inner ends along the margin of the clamp capsule. Behind this is a third pair consisting of one long and narrow component, another broad and short component. Both of these articulate with the lateral sides of the median spring. The wall of the clamp capsule has numerous cuticularized ridgelike thickenings.

Testes oval or spherical, 63–105 μ wide, nine in number, and distributed in a longitudinal, alternating intercrural row between the ovary and the intestinal confluence. Seminal vesicle irregularly oval, 60 × 48 μ, situated close to the anteriormost testis and with small vasa efferentia directed towards the testes. Vas deferens long and narrow, arises from the anterior margin of the seminal vesicle and extends forward ventrally to the left half of the ovary. Beyond this level it extends as a wavy duct parallel to the vaginal duct on its right side, and opens out through the male pore by way of the unarmed conical muscular penis. Male genital pore situated at the angle of intestinal bifurcation and 0.185 mm from the anterior end. It is a small ventral aperture with an irregular rim, armed with a circlet of 10 sickle-shaped short hooks (Fig. 11), which converge to the center of the pore.

Ovary median, C-shaped, situated in front of

the testes zone, with a proximal right end expanded into an oval mass representing the proximal ovary (Fig. 12). Ova are large in the distal part of the ovary. Oviduct arises from the distal end of the ovary, proceeds backward parallel to the left posterior margin of the ootype and opens into the latter at its base by the right side. Uterus wide with semicuticularized walls, arises from the anterior margin of the ootype, extends forward median ventrally and opens out by the uterine pore situated immediately in front of the male genital pore. Egg well formed, spindle-shaped, 80 × 36 μ, but with anterior filament broken, observed in the mid-ovarian zone.

Vitellaria coextensive with the crura and their branches from the level of intestinal bifurcation to the proximal level of the isthmus between the haptor and body. At this level vitellaria become confluent across the median line along with the intestinal confluence; vitelline follicles comparatively large, spherical or polygonal, 24–36 μ wide, few in number. Median and transverse vitelline ducts not observed.

Ootype median, spindle-shaped, 120 × 80 μ, situated between the loops of the ovary and covered by slightly elongated cells except for a central "white" space, where the various genital ducts meet (Fig. 12). Genito-intestinal canal arises from this space and opens into the right intestinal crus.

Vagina median dorsal, unarmed, of the same size as the male genital pore and situated in the angle of the intestinal bifurcation (Fig. 6). Vaginal duct median dorsal, crosses the ovarian zone and opens into the central wide space of the ootype; seminal receptacle triangular, 40 μ long, and placed between the proximal ovary and ootype close to the testes zone. A short narrow duct from the seminal receptacle opens into the ootype close to the entrance of the vaginal duct.

HOST: *Pristipoma guoraca* Blkr., on the gills.

LOCALITY: Trivandrum (southwest coast of India). One specimen collected 20 August 1955.

DISCUSSION

The genus *Urocotyle* is allied to *Choricotyle* Van Benden and Hesse, 1863, but differs markedly in the clamp structure. The platelike cuticularization of the median spring and its advancement as a cuticularized rim in *Urocotyle* is by far too important a character to be regarded as a variation. It is of definite significance in the evolution of the group. Moreover, the presence of a peglike spine on this cuticularized plate sufficiently warrants according this monogenoidean a new status. The short isthmus separating or connecting the body with the haptor of *Urocotyle* is not observed in any existing species of *Choricotyle*. The number of spines around the male genital pore may be of significance only in species, but the presence or absence of a definite vagina is of greater significance. In species of *Choricotyle* there is no vagina, while in those of *Urocotyle* a median dorsal unarmed vagina is present. In view of these marked differences *Urocotyle* is created as a new genus, with *Urocotyle pristipoma* n. sp. as the type species.

The generic name refers to the haptor with a tail, i.e., the lappet. The specific name refers to the host.

Dussumericola n. gen.

GENERIC DIAGNOSIS: Choricotylinae, with haptor demarcated from body by deep lateral constrictions. Clamps with long peduncles, median spring of the clamp broad and ringlike, with long spinous process; anchors and lappet absent; mouth with a sphincter-like ridge; pharynx larger than oral pouches; crura confluent with a median crus in the haptor; testes few, intercrural, post ovarian but not entering haptor; male genital pore in the mid-oesophageal region, armed with a ring of 10 curved hooks; ovary U-shaped; median vitelline duct very large; receptaculum seminis present; vagina unarmed, median dorsal at the intestinal bifurcation; vaginal duct joins the ootype through the receptaculum seminis; genito-intestinal canal arises from receptaculum seminis. Parasitic on dussumerid fishes.

GENOTYPE: ***Dussumericola dussumeria*** n. sp.

Dussumericola dussumeria n. sp.

Figs. 13–16

Body divisible into an anterior narrow neck, a median oval body, and a posterior expanded haptor formed of two winglike halves, the haptor being demarcated from the body by deep

lateral notches (Fig. 13). Total length 3.7–3.9 mm; maximum width across the ovarian zone, 0.9 mm.

Mouth subterminal, circular, bordered by a 'sphincter' of thin muscle fibers; oral pouches thin-walled, elliptical or oval, 16 × 12 μ–20 × 16 μ, situated behind the mouth and parallel to the median line; pharynx median, oval, 36 × 28 μ, and with a row of gland cells on each dorsolateral side. Pharynx and oral pouches have long muscle fibers extending to the level of the male genital pore. Oesophagus wide, without lateral branches and bifurcating into the crura at the level of the vagina 0.609 mm from the anterior end of the body; crura wide and saclike with irregular margin. At the junction of the body and the haptor the two crura become confluent and continue into the haptor as a single median crus which considerably expands in the base of the haptor. From the sides of this median crus are given off short stumpy branches to the bases of each peduncle. The intercrural field is reduced in front of and behind the ovarian zone owing to the highly expanded condition of the crura (Fig. 13).

Haptor forms slightly less than half the total length, with four pairs of pedunculate clamps; peduncles of varying length, each with a thick bundle of axial muscle fibers extending from the base of the clamp to the middle of the haptor; clamps triangular with rounded corners, 189 × 189 μ–210 × 210 μ, with fleshy capsule and thick lips but no riblike striae in the wall of the capsule. Clamp structure (Fig. 14) more or less as in *Urocotyle pristipoma;* but the lidlike median spring forms a broader cuticularized continuous ring at the base of the clamp, the spinous process is longer and narrower, paired sclerites on either side are long and narrow, and the clamp capsule contains two fleshy suckerlike pads, one at the base and another in the distal dorsal region of the clamp. Terminal lappet and anchors absent.

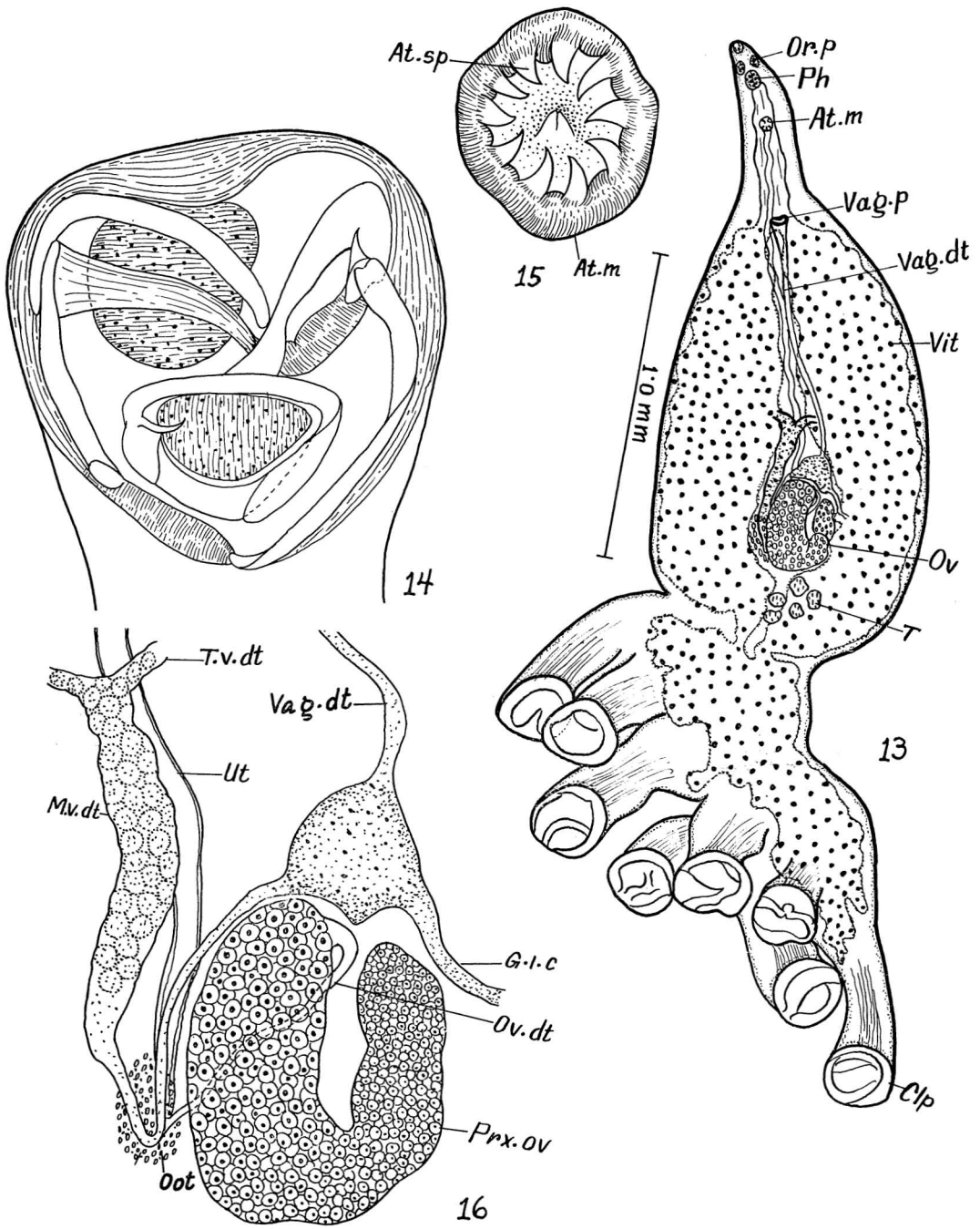
Testes five to six, spherical, 42 μ in diameter, and confined to a small intercrural space behind the ovary, not entering the haptor. Vas deferens long and narrow, arises from the anterior margin of the testes, runs forward along the median line and, crossing over to the left side of the vagina, opens into the base of the penis; penis muscular, conical, unarmed; male genital pore median ventral armed with a ring of 10 conical convergent cuticularized spines (Fig. 15) and situated midway between the mouth and intestinal bifurcation. Seminal vesicle and penis bulb absent.

Ovary U-shaped, 273 × 210 μ, and situated in the median intercrural field in front of the testes; proximal limb narrower and shorter with small ova, distal limb with large ova (Fig. 16); oviduct arises from the distal end of the ovary and curving downward runs obliquely beneath the ovary to open into the ootype close to the median vitelline duct; uterus long and narrow, arises from the anterior margin of the ootype and runs forward along the median ventral plane, where it can be traced up to the level of intestinal bifurcation.

Vitellaria coextensive with the crura from the zone of intestinal bifurcation to the terminal end of the median crus in the haptor; follicles spherical or polygonal, 21 μ wide; transverse vitelline ducts arise from each side in the middle of the body proper and unite to form a long, wide, median vitelline duct, with large follicles in the anterior two-thirds (Fig. 16). The narrow posterior end of this duct opens into the ootype.

Ootype small, oval, surrounded by two or three rows of small Mehlis' gland cells and situated at the terminal end of the median vitelline duct on the left posterior margin of the ovary.

Vagina, median dorsal (Fig. 13), unarmed, and in the form of a transverse slitlike aperture, situated at the level of the intestinal bifurcation; vaginal duct wide and thick-walled in the anterior half, while narrow and thin-walled in the posterior half. At the level of the transverse vitelline ducts the vaginal canal curves to the right side and opens into the anterior corner of the receptaculum seminis; receptaculum seminis median triangular, 126 × 126 μ, placed close to the anterior margin of the ovarian zone. From the left corner of the receptaculum seminis the vaginal duct continues around the distal limb of the ovary and opens into the ootype close to the oviduct. Genito-intestinal canal arises from the posterior margin of the receptaculum seminis, runs obliquely backward and opens into the right crus.



FIGS. 13–16. *Dussumericola dussumeria* n. gen., n. sp. *13,* Complete worm, dorsal view; *14,* proximal third clamp, dorsal view; *15,* male genital pore showing the armature of hooks; *16,* ovarian region, dorsal view.

HOST: *Dussumeria hasselti* Blkr., on the gills.

LOCALITY: Trivandrum (southwest coast of India). Two specimens collected 27 November 1954.

DISCUSSION

The genus *Dussumericola* possesses all the characters of the subfamily Choricotylinae, but at the same time it shows a number of unique characters which distinguish it from all the known genera included under the subfamily. It closely resembles *Urocotyle* n. gen. in many characters, especially in the structure of the clamps and the vagina, but differs from it in the shape and proportions of the body and in the absence of a terminal anchored lappet. *Dussumericola* approaches *Diclidophora* Dies. (Subfam. Diclidophorinae) in shape, but differs in the structure of the clamps. Moreover, in *Diclidophora* a vagina is lacking, while it is present in *Dussumericola.* The new genus differs from *Heterobothrium* Cerf., 1895, in the absence of a long isthmus between the body and the haptor and in the presence of a vagina. It closely resembles *Cyclobothrium* Cerf., 1895, and *Choricotyle* Van Benden and Hesse, 1863, in a number of characters, but differs from both in the presence of a vagina. The chief character which distinguishes the new genus from *Diclidophoropsis* Gallien, 1937, is that the latter possesses a double lateral vagina. The resemblance between the present species and *Echinoplema* Raecke, 1945, is more pronounced: in both the haptor is demarcated from the body by a prominent lateral constriction, the clamps have muscular pads, a terminal lappet is absent, a single vagina is present, and the vitellaria extend into the haptor; but in *Echinoplema* the vagina opens laterally, while in this species it is median-dorsal and situated at the level of intestinal bifurcation.

Thus the characters of this species which prevent its inclusion under any of the known genera of the subfamily are: (1) the presence of a wide median vitelline duct, (2) the comparatively large size of vitelline follicles, (3) the position of the testes in a limited space between ovary and haptor, the number of testes also being limited, and (4) the position of the single median vagina at the level of intestinal bifurcation. In view of these combinations of unique characters the new genus *Dussumericola* has been created to accommodate this new species, with *Dussumericola dussumeria* as the type species.

Both the generic and the specific name refer to the host.

Keralina n. gen.

GENERIC DIAGNOSIS: Choricotylinae, with a flowerlike circular haptor, with a complete circlet of eight clamps borne on short peduncles; clamps choricotylid but slightly more advanced in structure, capsule lip glandular; terminal lappet and anchors absent; oral pouches fibrous with muscular rim and a median triangular portion; pharynx with two rows of 'teeth,' with glandular and muscular parts; intestinal crura confluent posteriorly and with a median vesicular extension into the haptor; testes postovarian, penis and cirrus absent, male genital pore situated at the level of intestinal bifurcation and armed with eight converging hooks; vitelline follicles large; vitelline ampulla and genito-intestinal canal present; vagina median dorsal, unarmed, and situated in the angle of intestinal bifurcation; egg spindle-shaped and operculate with a filament at each pole. Parasitic on the gills of marine fishes.

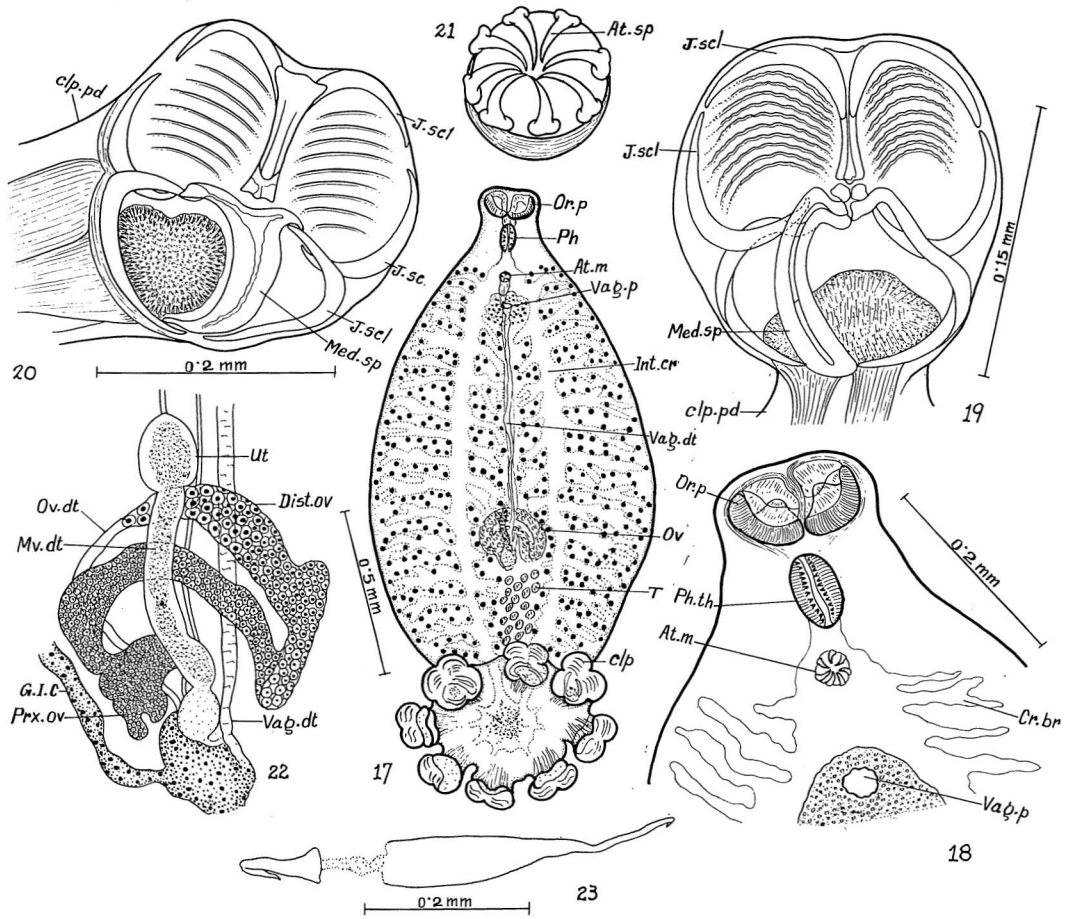
GENOTYPE: ***Keralina opisthopterus*** n. sp.

Keralina opisthopterus n. sp.

Figs. 17–23

Body broad and more or less oval, with an anterior short neck and a posterior flowerlike, horizontally expanded circular haptor (Fig. 17). Total length 1.15 mm–3.36 mm, and maximum width across middle of body 0.63–1.45 mm; type specimen 1.74 mm long and 0.84 mm broad.

Mouth subterminal, ventral transverse, and bordered by a thick muscular ridge; oral pouches more or less rectangular 63 × 63 μ–126 × 84 μ, cuplike, and fibrous, with a triangular muscular or glandular structure projecting from the base of the concavity (Fig. 18). The inner edges of the two oral pouches are parallel and placed close to each other along the median line; the posterior rim is broad and ridgelike with short



FIGS. 17–23. *Keralina opisthopterus* n. gen., n. sp. *17,* Complete worm, ventral view; *18,* anterior region, dorsal view; *19,* clamp, ventral view; *20,* another clamp, ventral view; *21,* male genital pore showing the armature of recurved spines; *22,* ovarian region, ventral view; *23,* egg.

muscle fibers extending from it to the posterolateral region of the pharynx. Pharynx large, thick, muscular, oval, 63 × 42 μ–126 × 63 μ with a longitudinal row of semicuticularized teethlike structures on each side projecting into the axial lumen; in one of the specimens the pharynx is divided into an anterior muscular and a posterior glandular portion. The pharynx and oral pouches occupy the greater portion of the neck region (Fig. 18). Oesophagus short and unbranched, bifurcating into the crura in front of the vagina; lumen of the crura at the bifurcation region comparatively large; each crus with very long horizontally parallel outer branches with short secondary branches which do not anastomose; intercrural branches short and directed obliquely backward but not confluent with those of the opposite side; posteriorly the two crura unite in front of the haptor and the united distal end expands into a vesicular structure from the periphery of which short branches lead to the base of each clamp.

Haptor closely resembling that of *Cyclobothrium* Cerf., but with a complete circlet of clamps; connected in the center to the narrow posterior extremity of the body. Clamps eight in number, squarish or polygonal, 126 × 147 μ–210 × 210 μ, and arranged radially along the periphery of the circular haptor; clamp peduncles very short with axial muscles extending

from the base of the clamp to the center of the haptor. Clamp structure (Figs. 19 and 20) more or less that of *Choricotyle elongata* (Goto) Llewellyn, 1941, but in a higher stage of evolution; median spring very broad and distally expanded horizontally so as to provide articulation for the lateral jaw sclerites; distal half of clamp with numerous transverse cuticular thickenings, basal half of the clamp capsule with a large bilobed muscular pad to which are connected the axial fibers of the peduncles, and the lip of the clamp capsule is fleshy and glandular. Terminal lappet and anchors absent.

Testes 19–22, small and spherical, 21–42 μ in diameter, and confined to the small intercaecal area between the ovary and the posterior crural confluence; vas deferens long and narrow, arises from the anterior row of the testes, runs forward ventrally along the median plane and opens into the male genital pore; male genital pore median ventral, situated at the level of intestinal bifurcation and armed with a circlet of eight small, elongately conical, cuticularized spines converging to the center of the pore (Fig. 21); each spine with a fleshy basal cushion embedded in the circular rim of the pore; penis and cirrus absent.

Ovary median, highly convoluted (Fig. 22), curved at right angles to the long axis of the body, and occupying an area 168 $\times$ 168μ–315 $\times$ 210 μ of the intercrural space in front of the testes; proximal ovary slightly lobed on the right side of the median line close to the ootype; oviduct arises from the distal end of the ovary and runs obliquely backward to open into the vitelline ampulla; uterus arises from the anterior end of the vitelline ampulla, proceeds ventrally along the median plane parallel to the vaginal duct, and is traceable up to the mass of gland cells surrounding the vaginal region; egg spindle-shaped and operculate, operculum 21 μ long and 42 μ broad, body 210 $\times$ 63 μ, anterior filament 126 μ long, and posterior filament 168 μ long.

Vitellaria coextensive with the crura and its branches from the level of intestinal bifurcation, and terminates slightly in front of the intestinal confluence; follicles large and spherical, 21 μ in diameter, not confluent posteriorly. Transverse vitelline ducts almost empty; median vitelline duct large and filled with vitelline follicles, in irregular dilatations especially at the anterior end, posteriorly the median vitelline duct opens into the vitelline ampulla; vitelline ampulla small, oval, or spherical and slightly embedded in the anterior margin of the receptaculum seminis, into which it opens.

Ootype apparently absent, but a genito-intestinal canal is present, which arises from the right posterior margin of the receptaculum seminis, runs obliquely forward, and opens into the right intestinal crus (Fig. 22).

Vagina median dorsal and unarmed, situated in the angle of intestinal bifurcation, and surrounded by a cluster of deeply staining small spherical gland cells (Figs. 17 and 18) which almost obliterate the vaginal opening; vaginal duct median dorsal, runs backwards as a straight tube, and opens into the receptaculum seminis; the receptaculum seminis is median, irregularly oval, 84 $\times$ 36 μ, and situated close to the posterior margin of the ovary.

HOST: *Opisthopterus turdoore* (Cuv.), on the gills and inner opercular wall.

LOCALITY: Trivandrum (southwest coast of India). Seven specimens, three collected on 22 December 1954, and four on 26 July 1955.

DISCUSSION

The genus *Keralina* closely resembles *Choricotyle* Van Ben. and Hesse, 1863, but differs in the shape of the body disposition of the clamps and in the structure of the clamp sclerites. Moreover, terminal lappet and anchors are absent. Of the various species of *Choricotyle,* the recently recorded American species *Choricotyle aspinachorda* Hargis, 1955, shows the closest resemblance to *Keralina opisthopterus.* They resemble each other in the shape of the body and the haptor, but differ markedly in the distribution of the testes and ovary. *Keralina* closely resembles *Cyclobothrium* Cerf., 1895, in the arrangement of the clamps, but the par- and pre-ovarian testes of *Cyclobothrium* are absent. Moreover, the size and relative position of the testes, the convoluted condition of the ovary, and the comparatively large size of the receptaculum seminis clearly distinguish the present species from *Cyclo-*

bothrium. Even though the new species possesses some of the characters of *Choricotyle* Van Ben. & Hesse and of *Cyclobothrium* Cerf., it is unique in possessing a vagina and the peculiar structure for the pharynx.

From the measurement of the organs in this species it is evident that the various organ systems may change their shapes, sizes, and even extent of distribution during growth; a short worm, 1.7 mm long, has all its organs relatively smaller than another, 3.36 mm long. In the present collection the type specimen is in the testicular phase and, as such, there are numerous testes and the ovary is very small ($168 \times 168\ \mu$), while a paratype 3.36 mm long is in the ovarian phase and the ovary is enlarged ($315 \times 210\ \mu$). In the latter specimen the testes are practically absent except for two or four, apparently being spent already in the testes phase. In a few specimens the receptaculum seminis is highly pronounced, while in others it is rather empty. The cuticularized structure and the structure of the oral pouches and pharynx do not vary much in this species, but the clamps increase slightly in size during growth. The most variable organs are the ovary and testes. Much emphasis is to be placed on the changeable nature of these organs and organ systems, lest their differences be treated as definitive, and consequently used in the creation of new species.

The generic name indicates that the parasite is found on the Kerala coast; the specific name refers to the host fish.

SUMMARY

From marine fishes of the Indian seas four new species of monogenetic trematodes belonging to the family Diclidophoridae Fuhrmann, 1928, *sensu* Price, 1943, are recorded and described. They are *Upenicola upenoides, Urocotyle pristipoma, Dussumericola dussumeria,* and *Keralina opisthopterus*. Each of these species has its own host and new genus. All inhabit local marine fishes belonging to closely related families (percoids and clupeids).

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